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Primary fallopian tube carcinoma. Evaluation of clinicopathological prognostic factors in 21 cases

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Summary. *Objectives:* Primary fallopian tube carcinoma (PFTC) is a rare cancer. Although comparable to epithelial ovarian cancer (EOC), PFTC may have different biology and prognosis than EOC. This single tertiary care hospital based study aims to evaluate the survival outcome and to identify factors that prognosticate the clinical outcome in PFTC patients. *Methods:* We retrospectively evaluated all the 21 patients diagnosed with PFTC between 2004-2013. We studied clinicopathological data to extract the prognostic factors for recurrence and survival. Kaplan-Meier curves were generated, and survival differences evaluated by using log-rank tests. *Results:* All the patients had pathologically proven PFTC. The mean age was 53.5 years (range: 36-69 years). Per-vaginal bleeding 11 (52.2%) and abdominal pain 5 (23.8%) of average duration of 2.7 months were the commonest symptoms. Stage distribution at presentation, International Federation of Obstetrics and Gynecology (FIGO)-1991 stage I,II,III,IV were 33.3%, 19%, 42%, 4.7% respectively. Commonest histology was serous-papillary carcinoma 18 (86%).Optimal debulking was done in 18 (85.7%) cases. Seventeen (81%) patients received paclitaxol-carboplatin adjuvant chemotherapy. Median follow-up period was 31 months (range: 6-127months). The disease free interval was 23.5 months. Five year Overall survival was 42.8%. Lymphovascular space invasion was associated with advanced stage (p=0.026) and earlier recurrences (p=0.044). Factors prognostic for overall survival were FIGO stage (p=0.008) and lymph node metastasis (p=0.038). *Conclusion:* Our single institution study results show that presence of advanced stage at diagnosis and lymph nodal metastases results in poor overall survival. Presence of lymphovascular space invasion indicates increased recurrence risk. Future clinical studies are warranted to identify the possible distinct clinical behaviour of PFTC.

Key words: primary fallopian tube carcinoma, survival, prognostic factors

1. Introduction

Primary fallopian tube carcinoma (PFTC) is an uncommon tumor accounting for approximately 0.14-1.8% of all female genital malignancies (1-3). A study from Finland reported that the incidence of PFTC is increasing (3). The true incidence of PFTC may be underestimated, because of the similar histological appearance of PFTC and epithelial ovarian carcinoma (EOC) (4). Clinical studies addressing specifically to

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PFTC, both population based (5-10) and case series (11-14) show variable data in disease characteristics and the outcome. Most of the disease characteristics and management principles of PFTC are followed as per that of EOC, which may not be true. Clinically and biologically, PFTC may be different from ovarian carcinoma. Especially the differences as suggested by previous studies about PFTC being different from EOC in symptomatology, stage at diagnosis, lymphatic spread and even the survival (13, 14). Also PFTC is recently recognized as a separate entity especially in the origin of the peritoneal and ovarian epithelial carcinomas and its association with BRCA-gene mutations and alteration in P53 gene (15, 16).

Hence it is imperative to recognize the clinical characteristics that can influence the disease process and outcome of PFTC patients. This can be helpful in better understanding the biological behavior of these tumors. Aim of the present study is to retrospectively evaluate the patients diagnosed with primary fallopian tube cancer at our institution. We tried to identify clinical factors and prognostic factors that are specific to patients diagnosed with PFTC in prognosticating the disease recurrence and survival.

2. Patients and methods

2.1 Study design

We retrospectively evaluated all the patients diagnosed histologically with PFTC at Department of Surgical and Gynecologic Oncology at our institution. The hospital data yielded a total of 21 cases with PFTC diagnosed between February 2004 and July 2013. All the lesions were staged according to the International Federation of Obstetrics and Gynecology (FIGO)-1991. Cases were identified according to PFTC diagnostic criteria established by Hu *et al*. (17) and modified by Sedlis (1). These criteria are: - (A) the main tumor arises from the endosalpinx; (B) the histological pattern reproduces the epithelium of tubal mucosa; (C) transition from benign to malignant tubal epithelium is demonstrable; and (D) the ovaries or endometrium are either normal or contain a tumor that is smaller than the tumor in the tube. All slides were reviewed by gynecologic oncopathologist. Staging information was derived from surgical notes and pathological reports. Data pertaining to patient characteristics, operative findings, histopathological details, treatment regimen, pattern of recurrence and survival was analysed. Our study was approved by the Hospital Ethics Committee. Informed consent was not required being the retrospective nature of the study.

2.2 Surgical strategy

Primary surgery consists of midline laparotomy followed by systematic examination of pelvic and intra-peritoneal structures to clinically stage the disease. Ascitic fluid (peritoneal wash if absence of ascites) collected for cytological examination. This is followed by total hysterectomy and bilateral salpingo-oophorectomy. All the intraperitoneal disease and palpable lymph nodes was optimally debulked (less than 1 cm of residual tissue). In early stage cases where no demonstrable peritoneal disease, systematic peritoneal biopsies taken.

2.3 Perioperative management

Few patients with very advanced disease based on initial imaging findings received neoadjuvant chemotherapy, this was followed by interval debulking surgery (usually after 3 cycles) followed by adjuvant chemotherapy. Adjuvant chemotherapy started 3 to 4 weeks after surgery and consisted of Paclitaxel+ Carboplatin or Carboplatin alone or Cyclophosphamide+Cisplatin. Recurrent cases were managed by secondary cytoreductive surgery or second line chemotherapy. Radiation therapy was offered for patients with painful bony metastasis. All patients were followed up in outpatient department every 3 months for initial 2 years, followed by visits every 6 months for 3 years and then annually. History and physical examination, serum Carbohydrate Antigen (CA-125) and ultrasonography of the abdomen and pelvis (if felt necessary) was done in every visit. If the findings show suspicion of recurrence and/or symptomatic patient, Computerized tomography (CT scan) of abdomen and pelvis was done and subsequently treated.

2.4 Statistical analysis

Disease free interval (DFI) was determined as the time from the date of end of primary treatment until the date of evidence of recurrence or the date of death from any cause, if recurrence did not occur prior to death. Overall survival (OS) was defined as the time from the date of start of treatment until the date of death from any cause, or till the date of last follow up. Surviving patients were censored at the date of last follow-up. Kaplan-Meier curves were used to calculate the mean overall survival (OS) and disease-free survival (DFS), and the log-rank test was applied for univariate analysis. All statistical analyses were carried out using IBM SPSS Statistics 20.0 software. The differences were considered statistically significant at a level of p-valve less than or equals to 0.05. For finding the association between categorical variables, Fisher's Exact Test was done.

3. Results

3.1 Clinico-pathological findings

A total of 21 patients with PFTC were identified during this period. The clinicopathologic characteristics of the patients are demonstrated in table-1. At diagnosis, the mean age was 53.5 years (range: 36-69 years). Eight (38%) patients were premenopausal. Abnormal per-vaginal bleeding or discharge 11(52.2%) and abdominal pain 5 (23.8%) were the most common symptoms. The average duration of symptoms was 2.7 months with 71.5% patients having duration of symptoms less than 2 months before presentation. At presentation, clinical FIGO staging was as follows-stage I-7 (33.3%), stage II-5 (23.8%), sage III-8 (38%), stage IV-1 (4.7%). Median CA125 at diagnosis was 335 kU/L. Preoperative CT-scan could diagnose the clinical stage accurately in about half the cases.

Commonest histology was serous-papillary carcinoma 18 (86%). Nine (43%) tumors were poorly differentiated, 9 (43%) were moderately differentiated, and 1 (4.7%) was well differentiated. Eleven patients underwent systematic lymph node dissection out of which 3 (27%) patients had metastatic lymph nodes.

Table 1. Patient and disease characteristics

Mean age	53.5 years (range: 36-69 years)
Parameters	No. (%)
Prior sterilization	
1. Yes	4 (19)
2. No	13 (62)
3. Data unavailable	4 (19)
Menopausal statue	
1. Premenopausal	8 (38)
2. post menopausal	9 (43)
3. data unavailable	4 (19)
Presenting symptoms	
1. Per vaginal bleeding/discharge	11 (52.3)
2. Abdominal pain	5 (23.8)
3. abdominal lump	3 (14.2)
4. Urinary symptoms	2 (9.5)
5. other nonspecific symptoms	3 (14.2)
Ascitis	
1. Yes	9 (43)
2. No	12 (57)
CA-125-(kU/L)	
1. less than or equals- 250	7 (33)
2. More than 250	9 (43)
3. value unknown	5 (23.8)
Histology	
1. Serous papillary adenocarcinoma	19 (90)
2. Transitional cell carcinoma	2 (10)
Histological grade	
1	1 (4.7)
2	9 (43)
3	9 (43)
Unknown	2 (9.5)
FIGO stage	
I	7 (33.3)
II-	5 (23.8)
III	8 (38.0)
IV	1 (4.7)
Primary treatment received	
1. Primary debulking surgery	18 (86)
2. NACT followed by surgery	3 (14)
Surgical procedures	
1. Staging laparotomy (clinical stage I cases)[a]	6 (28.5)
2. Optimal debulking[b]	12 (57)
3. Suboptimal staging [c]	2 (9.5)
4. Suoptimal debulking[d]	1 (4.7)

Abbreviations: FIGO-International Federation of Gynecology and Obstetrics; CA-carbohydrate antigen.

[a] Staging laparotomy- total abdominal hysterectomy with bilateral salpingo-oophrectomy with omentectomy with peritoneal wash with peritoneal biopsies with or without lymphadenectomy; [b]Optimal debulking- total abdominal hysterectomy with bilateral salpingo-oophrectomy with omentectomy with any one of the following: lymphadenectomy, bowel or bladder surgery , extensive tumor debulking, splenectomy so as to have no or less than 1 cm of residual disease; [c] incidental finding of stage I PFTC on laparotomy; [d] Suboptimal debulking: >1 cm of residual disease.

Pathological staging was as follows-stage I-8(38%), stage II-5(24%), stage III-8(38%). One patient with stage IV disease had adnexal mass with metastatic left supraclavicular lymph node.

3.2 Treatment results

Overall optimal primary debulking was possible in 18(85.7%) patients. Two (10%) patients had incomplete staging owing to the initial uncertain diagnosis of small adnexal mass in these cases. These two patients refused further completion staging surgery and adjuvant chemotherapy. Neoadjuvant chemotherapy was given to 3(14%) patients in view of extensive disease on preoperative imaging. Adjuvant chemotherapy was given to 17(81%) patients. (2 patients refused, 1 patient died in post operative period and 1 patient lost to follow up after initial surgery). All patients completed the prescribed cycles. Chemotherapy regimen was 6 cycles of paclitaxel 175 mg/m^2 and carboplatin AUC 6 (area under the curve) (13 patients) or carboplatin AUC 5 alone (3 patient) or CP (cyclophosphamide - 500 mg/m^2 and cisplatin - 75 mg/m^2) (1 patients). Follow-up was possible in 18 patients. Median follow-up period was 31 months (range 12-127 months). One patient died in post-operative period due to cardiac arrest and 6 patients died during follow up period. Recurrence was seen in 9 patients (43%), most commonly intraperitoneal (5 of 9). For patients with recurrence, second line chemotherapy was given in 5 patients, secondary debulking surgery done in 2 patients and palliative radiation therapy for 2 patients with symptomatic bone metastasis.

Table 2. Univariate analysis of group-wise correlation of the proposed prognostic factors and respective 5 year survival

Factors	Groups	No. of patients	5 year Overall survival %	P-value
Age	Less than 50 years	8	42.0	
	More than 50 years	13	42.8	0.214
Prior sterilization	No	13	38.4	
	Yes	4	50.0	0.157
Symptoms at diagnosis[a]	PV spotting +/- pain	11	53.8	
	Others	10	28.5	0.117
Duration of symptoms[a]	Less or equals 2 months	12	40.0	
	More than 2 months	9	60.0	0.649
Preoperative CA125 levels	less than 250	7	40.0	
	More than 250	9	37.5	0.380
Ascites	No	12	41.6	
	Yes	9	50.0	0.194
Grade	I, II	10	22.2	
	III	9	66.0	0.277
Lymphovascular space invasion[b]	No	5	60.0	
	Yes	11	30.0	0.056
FIGO Stage	I, II	12	58.3	
	III, IV	9	22.2	0.008
Lymph node status	Negative for metastasis	8	42.8	
	Positive for metastasis	3	0	0.038
Recurrence	No	11	63.3	
	Yes	9	22.2	0.003

Abbreviation: FIGO-International Federation of Gynecology and Obstetrics. CA125- Carbohydrate antigen.
[a]also had no difference for stage of the disease.
[b]also had no statistically significant difference for stage (p=0.026) and Disease free interval (p=0.044).

3.3 Prognostic factors and outcome

Median overall survival (OS) was 40 months (range 14 to 177 months). Stage-wise overall survival at 5 year was 57%, 60%, 25%, 0% for stage I, II, III and IV respectively

Analysis of all the proposed prognostic factors as shown in Table 2, there was a statistically significant difference in length of median OS between early FIGO stages (stage I, II) with 5 year survival of 58.3% as compared to advanced stages (stages III, IV) with 5 year survival of 22.2% (p-0.008). None of the patients with lymph nodal metastases were alive at 5 years as compared to patients without lymph node metastasis who had 5 year survival of 42.8% (p-0.038). Patients having tumor without Lymphovascular space invasion (LVI) had trend towards survival benefit than those having tumor with lymphovascular space invasion (median overall survival of 36 months versus 60 months respectively; p-0.056). The Kaplan-Meire survival curves of above prognostic factors are shown in figure 1.

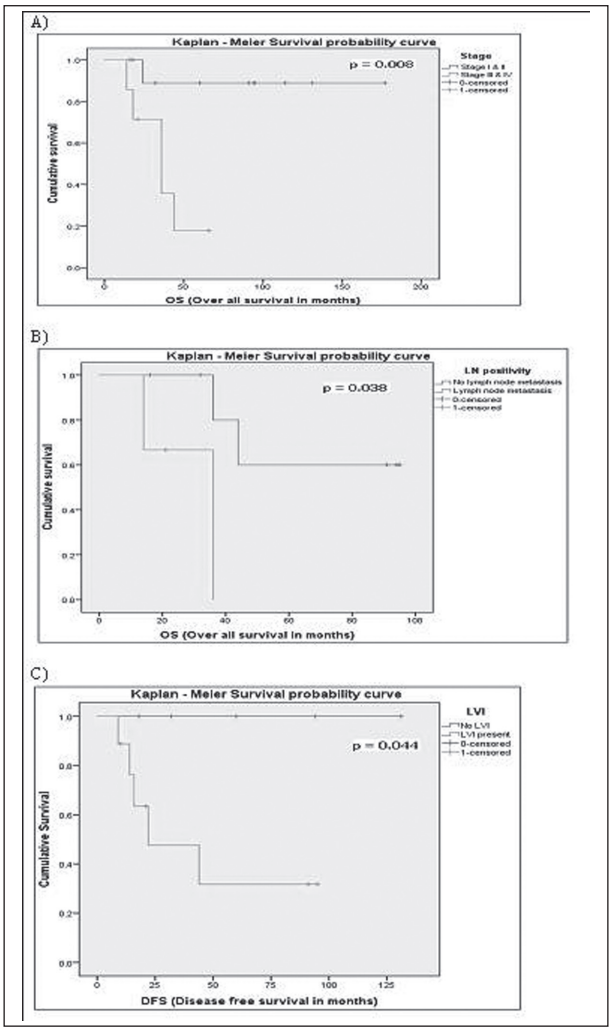

Figure 1. Kaplan-Meier Survival curves showing survival probabilities of different statistically significant prognostic factors with outcome. A) Overall survival with FIGO stage. B) Overall survival with Lymph node metastasis. C) Disease free survival with Lymphovascular space invasion

The overall Disesase Free Interval (DFI) in present study was 23.5 months (range 9 to 131 months). Recurrence of disease was seen in 9 (43%) patients. As expected, patients with recurrent disease had poorer overall survival than those without recurrence (Median OS 24 months versus 66 months) (p-0.003). The disease free interval (DFI) of patients having tumour without LVI (60 months) was significantly longer than those with LVI (19.5 months) (p=0.044) (figure 1). None of the other parameters like age, prior sterilization, menopausal status, CA125 levels, ascites, debulking rate and tumor grade had any impact on the DFI or OS. The type of symptoms and duration of symptoms did not correlate with the stage of the disease. Upon subgroup analysis, absence of LVI in the tumor correlates with early stage of the disease (p=0.02). Other disease characteristics like type of symptoms (p=0.087), duration of symptoms (p=0.331), CA125 level (p=0.615), grade (p=0.370) failed to correlate with the stage.

4. Discussion

4.1 Demography

Primary fallopian tube carcinoma (PFTC) is a rare gynecological malignancy. Various studies have shown the incidence to be from 0.14 to 1.8% of all genital malignancies (3, 10, 18). The true incidence of PFTC may however, have been underestimated (18) due to misinterpretation of PFTC as ovarian tumors during initial surgery and/or during microscopic examination because of the similar histological appearance of these neoplasms (9). In our institution, the incidence of PFTC among all the gynecological malignancies is 1.4% (21 cases out of 1426 cases of all the gynecological malignancies diagnosed during the study period). Historically, the histological appear-

ance and overall management of PFTC is nearly like EOC. The most frequent age of occurrence of PFTC is between the fourth and sixth decades of life with the mean age of 55 years (19-21). The mean age of occurrence of PFTC in our study was 53.5 years (range, 36-69 years). More than half patients in our study were postmenopausal (57%), as has already been reported in the literature (5, 18). High parity was observed to be protective (22). The mean parity of our patients was 2.2. One patient (4.7%) was nulliparous.

4.2 Pre-operative diagnosis

The reported rate of preoperative diagnosis of PFTC is in the range of 0%-10% (21, 23). Preoperatively PFTC cases can be diagnosed as ovarian malignancy since the clinico-pathological factors which are specific to PFTC are rare. The symptoms suggestive of PFTC are not specific. Latzko's triad of symptoms, consisting of -intermittent profuse serosanguinous vaginal discharge, lower abdominal colicky pain relieved by discharge and abdominal or pelvic mass has been reported in 15% of cases (18, 19). This typical triad was seen in 3 of our patients (14%). Few studies have mentioned certain preoperative features that could indicate the site of the disease as fallopian tube rather than the ovary. These includes- short duration of the symptoms, diagnosis at an earlier stage because of abdominal pain secondary to tubal distention (18, 19, 24) and adnexal mass along with postmenopausal per-vagubak spotting. In our study 71% patients had shorter duration of symptoms (less than 2 months) and two-third of these patients had early stage disease (stage I, II) although this was not statistically significant. About half of our patients had per-vaginal spotting or discharge with or without abdominal pain. This phenomenon is not usual in ovarian carcinoma. Intraoperatively we could make out a tumour of tubal origin in early stage tumours, but for advanced stage tumours which noted as tubo-ovarian mass and peritoneal deposits, required histopathological examination to confirm the primary site as fallopian tube.

The tubal neoplastic lesion has typical imaging features demonstrable with ultrasound examination preferably transvaginal or with Computerized tomogram (CT scan) or Magnetic Resonance imaging (MRI). These features are- a distal tubular mass with hydrosalpinx, a tubular tortuous solid-cystic mass, peritumoral ascitis. MRI seems to be better than CT scan or ultrasound in detecting advanced tumor infiltration in pelvic organs (25, 26). In our patients CT scan based staging of the disease was accurate in these patients when correlated with the pathological stage.

All but two of our patients had elevated serum CA125. Various studies have shown that CA125 even though nonspecific for diagnosis in up to 80 % of cases, will be high in PFTC. It is a useful independent prognostic marker to assess clinical response to therapy and detect recurrences (19, 27). Average CA125 level in our study was 335 kU/L (range 12.5 to 3711 kU/L). Due to such a wide range, we tried to analyze the different levels of elevated CA125 (e.g. less or more than 250 kU/L) to prognosticate the disease status, but we failed to show any cut off level to be significantly association with recurrence or survival.

4.3 Histopathology

The most common histological type is serous (papillary) carcinoma with reported incidence of 44%-83.3% (2). Nineteen (90%) of our patients had papillary serous carcinoma. Second commonest histology in our study was transitional cell carcinoma (10%) which is consistent with the value reported in the literature of about 11%.

4.4 Management of PFTC

Surgical management is the treatment of choice for PFTC on the grounds of EOC with recommendations for optimal debulking (less than 1 cm of residual disease, preferably nil) (12, 28). One study has noted the intraoperative frozen section for accurate diagnosis in early stage disease (29). Optimal debulking of the tumor is shown to be the independent prognostic factor for survival (12, 30). In present study 18 (85.7%) of the cases had optimal debulking. Our patients who received neoadjuvant chemotherapy 3 (14%) followed the same trend in outcome as the rest advanced stage cases. Adjuvant cytotoxic chemotheraphy was received by 17 (81%) of our patients. Adjuvant chemotherapy with taxane and platinum combination has been shown to

give the best response rate of up to 87% to 93% (31, 32). Thirteen of 17 patients received the same combination chemotherapy (76%) in our study. Four patients who received chemotherapy other than this combination, had inferior outcomes than those who received combination chemotherapy (DFI of 16months versus 32 months and OS of 40months versus 60months) although this difference did not reached statistical significance.

4.5 Prognostic factors

4.5.1 Lymph node metastasis

Presence of lymph node metastasis indicates poor prognosis (11). Data from the literature indicate that patients with PFTC have a higher rate of retroperitoneal and distant metastases than those with EOC. In the literature the documented rate of metastases to the regional lymph nodes is about 33% of the patients with all stages (24, 33-37) (Table 3). And therefore it has been recommended to do the lymph node dissection preferably both pelvic and para-aortic region during surgical staging for suspected PFTC (19, 24, 33, 38). In our study, the lymph node metastasis was seen in 3(27%) out of 11 cases who underwent lymphadenectomy. Two cases showed metastasis in para-aortic lymph nodes sparing the iliac lymph nodes. Those patients who had positive lymph nodes had significantly poor overall survival than those without lymph nodal metastases (p-0.038). These findings are similar to the rate of nodal metastases seen in the previous studies (Table 3).

4.5.2 Lymphovascular space invasion

Present study identifies Lymphovascular space invasion (LVI) to be predictive of stage of the disease and prognostic with respect to disease-free survival.

Table 3. Studies showing the rate of lymph node metastasis at initial surgery of primary fallopian tube carcinoma.

Author	Total No. of patients	Patients with lymph node metastasis	%
Tamini and Figge (34)	15	5	33
Maxson et al (36)	5	2	40
Schray et al (35)	34	12	34
Klein et al (33)	81	29	36
Isabel Alvarado-Cabrero (37)	85	34	40

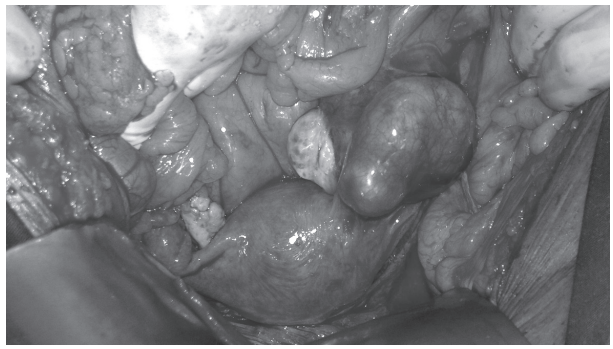

Figure 2. Intra-operative photograph depicting the distended fallopian tube containing the tumor (arrowhead). Note the adjacent normal ovaries and uterus ('left-right-down' arrow)

In the literature LVI as a prognostic marker has not been studied in details. It is mentioned to be an adverse prognostic factor (30). Isabel Alvarado-Cabrero *et al* (37) has noted a correlation of LVI with lymph node metastasis and the stage of the PFTC. In our study, LVI was seen in 11of 16 examined cases (69%). Patients with tumours showing LVI had advanced stage (72% stage III IV, p-0.026). None of the patients without LVI had advanced disease. Patients with LVI had early recurrences (DFI of 19.5 months) which was statistically significant than those patients having tumors without LVI (DFI of 60months) (p=0.044). Also these patients had trend towards poorer 5 year overall survival, 30% versus 60% for tumours with and without LVI respectively (p=0.056).

4.5.3 Stage (FIGO)

FIGO stage has been shown to be an independent prognostic factor (12, 32, 37). The stage wise distribution of cases in present study was stage I-33.3%, stage II-23.8%, stage III-38% and stage IV-4.7% which is consistent with the recent review of PFTC by E. Kalampokas *et al* (39) where incidence was 20-25%, 20%, 45-50% and 5-10% of stage I,II,III,IV respectively. In present study 5 year overall survival for early stage disease (stage I,II) was significantly greater than advanced (stage III,IV) disease (58.3% versus 22.2%: p=0.008).

4.6 Patterns of recurrence

Observations by Wolfson AH *et al* (6) regarding patterns of recurrence in their study included 18%

Table 4. Studies evaluating the stagewise 5-year survival in PFTC patients

Series	no. of patients	5-year survival Stage I	Stage II	Stage III	Stage IV	Overall
Rosen *et al* (9)	143	59%	19%	43%	-	-
Kosary and Trimble (8)	416	95%	75%	69%	45%	-
Heintz *et al* (40)	175	81%	67%	41%	33%	56%
Wethington SL *et al* (13)	1574	81%	-	65%	-	54%
Present study	21	57%	60%	22.5%	0%	42.8%

pelvic, 36% upper abdominal, and 19% distant recurrences. For all patients, upper abdominal failures were more frequently found in advanced stages at presentation. Similarly, in our study 9 (42%) patients had recurrence, metastases in the upper abdomen and at distant sites were 33% and 44% respectively. All the recurrences occurred in patients with advanced stage (stage III) at presentation. Median disease free interval (DFI) in our study was 23.5 months.

4.7 Overall survival

Overall survival in PFTC varies from 22% to 56% among different studies as seen in Table 4. The wide disparity in reported results from different studies are explained by inherent biases present in retrospective reviews, studies covering many years, lack of uniform and consistent staging, inconsistent adjuvant chemotherapy and/or radiation use, non standardized chemotherapy regimens used, and lack of central pathology review. Study done by Wethington and colleagues (13) including SEER data of 1574 PFTC patients from 1988 to 2004 with overall 5 year survival for stages I, II, III and IV was 81%, 65%, 54% and 36% respectively. In present study 5 year overall survival for all stages was 42.8% and 5 year survival stage wise as 57%, 60%, 22%, 0% for stage I, II, III and IV respectively. We observed overall survival to be poor in patients with advanced stage (stage III and IV), patients with metastatic lymph nodes, patients with LVI and patients with recurrent disease. Wethington and colleagues also compared the PFTC data with EOC data and concluded that those patients with fallopian tube carcinoma were more likely to present with earlier stage tumours. Stage I/II had similar survival in the two groups but those patients with stage III/IV PFTC had a better overall survival (54% versus 30%) compared to stage III/IV ovarian cancer patients. Hence PFTC can be identified as a separate entity and further research is needed to study the factors which decide the outcome of this malignancy.

5. Conclusions

Fallopian tube carcinoma is a rare gynecological malignancy. Small number of patients, large study period and absence of prospective data (as happened in present study also) are few limitations in studying such a rare tumour. Nonetheless present study could identify certain prognostic factors like FIGO stage at presentation and presence of lymph node metastasis which affect the survival outcome in these patients. Presence of tumors showing lymphovascular space invasion indicates higher stage and high risk for recurrence and trends towards poor survival. The behavior of PFTC may be different from EOC in symptomatology, lymph node metastasis, and overall survival. Further research to understand the unique molecular mechanisms that promote fallopian tube cancer and possibly fallopian tube as the source for epithelial ovarian and peritoneal cancers needs to be carried out. Further studies, both laboratory and clinical, are needed to delineate the differences between fallopian tube and ovarian cancers and development of treatment paradigms that specifically target fallopian tube carcinoma.

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